

Water Quality Monitoring

2023

This document includes all the information you will need to help in the Muskoka Lakes Association 2017 Water Quality Monitoring program.



Volunteer Manual

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1. The MLA

The Muskoka Lakes Association's mission is to promote the responsible use, enjoyment and conservation of the unique Muskoka environment.

Our efforts are concentrated in four areas:

1. **We protect and promote water quality** – The MLA operates the most comprehensive citizen science water monitoring program of any lake association in Canada. Known as the Water Quality Initiative, this program focuses on the near shore, where members access water near their residences. The MLA shares this data with district and municipal governments, and when issues arise, works with a variety of stakeholders to find solutions.
2. **We advocate for responsible government and fair taxation** – The MLA believes fair waterfront taxation depends on responsible, efficient spending by district, municipal and provincial governments.
3. **We promote responsible land use** – The MLA advocates for strong environmental standards and smart, forward-thinking land use and development planning that respects the unique character of Muskoka's communities.
4. **We lead on important Muskoka issues** – The MLA participates in the efforts of Muskoka's district and municipal governments, reporting back to members and taking action on issues that affect waterfront property owners.

The fun side of cottaging

Serious issues are important, but let's face it: a trip to the cottage is all about having fun with family and friends. That's why the MLA supports, funds or operates a variety of cottage-focused events, including an annual aquatic regatta, sailing regattas, biennial boat show, bonspiel and seedling day. We produce an annual, high quality yearbook, and keep our members up-to-date on Muskoka happenings with a regular newsletter.

To learn more about the Muskoka Lakes Association and the efforts of its committees, please go to www.mla.on.ca

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2. Introduction

This Volunteer Field Manual is a step-by-step guide for volunteers to collect biological (bacteria), chemical (phosphorus) and physical (clarity and temperature) water quality data.

Why we monitor

Government agencies, including the District of Muskoka, monitor our environment. So why does the MLA also monitor? There are two important purposes of the MLA's program. First, government agencies don't monitor all of the areas that the MLA is interested in, and they don't monitor all of the parameters that the MLA is interested in. Our program is kind of like a "double-check" on the results of other monitoring programs.

Second, other agencies are interested in evaluating whether whole lakes have "acceptable" water quality. The MLA program on the other hand, tries to find causes when the acceptable threshold has been crossed.

What we monitor

The table below is a summary:

| Parameter | Type | Who measures? | Sources | Indicates | Actions |
|--------------------------------|------------|-----------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Total Phosphorus | Chemical | MLA District Province | Fertilizers, soaps, sewage, agriculture. | Eutrophication (algae and plant growth), colour, fish habitat. | Plant vegetation, do not fertilize, maintain/replace septic systems. |
| Calcium | Chemical | MLA District Province | Occurs naturally in nature. | Low levels indicate that the lake cannot support animals that are important to the ecosystem. | Once baseline is created, monitoring is required with less regularity |
| Dissolved Organic Carbon (DOC) | | MLA District | Occurs naturally in nature. | Whether phosphorus sources are man-made or naturally occurring | |
| Total Coliform | Biological | MLA | Wildlife, wetlands. | Biologically active ecosystem. | |
| <i>E. Coli</i> | Biological | MLA | Sewage, wildlife, agriculture. | Fecal contamination, abnormal ecosystem. | Maintain/replace septic systems, plant vegetation. |
| Clarity | Physical | MLA District Province | Fertilizers, storm water, sewage, boat traffic, construction, agriculture. | Eutrophication, erosion. | Plant vegetation, control erosion, avoid destructive behavior. |
| Temperature | Physical | MLA District Province | | How biological and chemical factors will affect ecosystem. | |

Leaving your natural shoreline intact (or if need be, replacing it) and maintaining your septic tank in good working order are the most important actions any of us can take towards protecting our lakes. We can also avoid using chemical cleaners and phosphate soaps, mitigate erosion on our properties, and at all costs avoid using fertilizers (chemical or natural!).

Where we monitor

Monitoring sites have been carefully selected. They consist of a series of “deep water” locations (near the middle of a bay or small lake) and “near shore” locations (near the shoreline). Near shore locations are located where the water depth is about 1 meter.

Sites cannot be changed by any member of the volunteer team. Sites are chosen as part of an on-going, long-term effort to monitor the water quality of the Muskoka Lakes. As such, sites are chosen for specific reasons, and cannot be dropped or eliminated once the sampling season has started. If members of the volunteer team feel new sites should be added or other changes should be made, consultation with the Water Quality Committee must be made prior to the beginning of the sampling season. Once the sampling season has started, no changes will be permitted.

Criteria is outlined in the table below:

| Parameter | Site Selection |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total Phosphorus (TP) | <ul style="list-style-type: none"> TP measurements are taken at many deep water locations in the spring (these are known as “spring turnover” measurements). They indicate the overall health of the area. If these indicate that the area has surpassed an acceptable threshold, TP is measured at the deep water location throughout the summer. Near shore sites are located near denser land uses and where major streams enter the lake. These help to indicate where specifically the TP concentration is too high, and why it is too high. |
| DOC (Dissolved Organic Carbon) | <ul style="list-style-type: none"> Originates from terrestrial and wetland sources and is the primary source of external organic carbon in fresh water lakes. One approach to investigate the source of elevated nutrients (phosphorus) is to examine the relationship of DOC with total phosphorus. Elevated phosphorus levels coupled with elevated DOC levels are a good indication of natural nutrient inputs. Elevated phosphorus levels without elevated DOC levels are a good indication of nutrient inputs, other than natural sources such as wetlands, etc. |
| Calcium | <ul style="list-style-type: none"> Monitored at deepwater sites only |
| Bacteria (total Coliform and <i>E.Coli</i>) | <ul style="list-style-type: none"> Bacteria measurements are taken in near shore areas with denser development. Near shore sites are located near denser land uses. This is because areas with dense development are more likely to have high, human-caused bacteria levels, and they are also more likely to be used for recreational purposes. Bacteria are collected from locations that have had higher bacteria levels in the past. |
| Clarity | <ul style="list-style-type: none"> Clarity is measured by secchi disk at all deep water locations identified for TP measurements. |
| Temperature | <ul style="list-style-type: none"> Surface water temperature is recorded for all monitoring locations. |

3. Legal & Safety

While you are participating in the monitoring program, please be safe! Remember these points:

- Always sample in a team of at least two for safety
- Always wear a life jacket or PFD when you are in the boat
- Watch for people swimming and playing in the water as you approach shore

Pleasure Craft Operators Card requirements

If you operate a boat you must have a Pleasure Craft Operator Card.

The Office of Boating Safety (Transport Canada) recommends that all boaters take a boating safety course. Having more knowledgeable boaters on our waterways will contribute to reducing the number of injuries and incidents and will save lives.

Required safety equipment

For more information please visit www.tc.gc.ca/BoatingSafety

There are safety equipment requirements that apply to all pleasure craft. Volunteers use a number of different types of boats to collect samples. Don't forget to check your safety equipment regularly – especially after taking your boat out of winter storage.

Refer to the boating safety manual before heading out on the water each and every time.







License

Please ensure that your boat is licensed and registered properly. You must have a valid Hull Identification Number, Compliance Notice and License number. For more information see Transport Canada's Office of Boating Safety website at: www.tc.gc.ca/BoatingSafety.

4. Equipment

Provided:

- 1 Volunteer Manual
- 1 plastic tray to carry the samples in
- 1 thermometer for measuring the air and water temperature

| | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Waterproof Sharpie pen for marking phosphorus samples and filling out the data sheet</p>  | <p>Bacteria glass jars corresponding to the number of sites to be sampled (if applicable)</p>  | <p>Phosphorus bottles corresponding to the number of sites to be sampled (if applicable)</p>  | <p>Large collection plastic bottle including fasteners (zip ties)</p>  |
| <p>Filter</p>  | <p>DOC bottles (if applicable)</p>  | <p>Secchi disk with clip and rubber ties</p>  | <p>Wax pencil to mark bacteria jars (if applicable)</p>  |

You must provide:

- A cooler large enough to hold all samples as you collect them.
- Ice, sufficient for keeping samples cool until you leave them with your Team Leader.

5. Roles & Responsibilities

As a volunteer, you are a representative of the MLA or your Affiliate Association.

You are participating in the Water Quality Monitoring program without remuneration as part of a volunteer team.

The responsibilities of your team are:

- The collection of lake water samples and recording of water temperature and data at all sites within your designated sampling area according to WQ protocols outlined in your Volunteer Manual; and
- Delivery of the samples to your Team Leader at the agreed upon time.
- You may also be requested to occasionally re-sample a particular site, or sites, if the need should arise.

6. Collecting your Samples

There are a few important points that everyone needs to remember when taking samples.

- Mark the dates you are required to sample on your personal calendar. Consult with your Team Leader and other volunteer team members; try sharing the schedule evenly.
- Be familiar with the details of the MLA Water Quality program so that you can explain it to others as they may be nervous if they see you poking around the end of their dock.
- Refer any questions you can't answer to your Team Leader or the MLA Office (705-765-5723).
- Do not stir up the bottom with your boat. Try to coast into the location, or use a paddle to "pole" your way in towards the shore.
- All samples must be dated.
- Make sure you match the code on your sampling bottle or tube with the site number you are sampling and the space you record your data on the sheet.
- All samples must be kept on ice and in the dark until they are turned in (a regular picnic cooler works great).
- All samples must be turned in to your Team Leader.

Sampling Procedures

Before you get in your boat:

1. Refer to the equipment list included for your area. Look through your equipment kit to make sure you have all of the equipment you need.
2. Find a data sheet in your binder.
3. Fill out the top portion of the data sheet before you head out to minimize the amount of writing you need to do in the boat. Include the air temperature, what time you begin sampling, whether or not there was significant rainfall over the preceding 24 hours and list the sample sites.
4. Consult the map of your sampling area that is included in your information package. Plan out your route and arrange your sampling bottles accordingly. Remember that the sites might not be numbered in the same order you choose to visit them.
5. Put the dates on the appropriate number of bottles using the Sharpie. Put the site code on the bacteria jar lid using the wax pencil.
6. Anyone who is touching the bottles and caps must rinse their arms and hands to remove any sunscreen, soap or lotion to avoid sample contamination.
7. Make sure you have all of the safety equipment you need in your boat, always test with a partner and head out to your first sampling location.

At each site:

1. Approach the site using GPS coordinates or the map included in this manual.
2. If you are taking a near shore sample, coast into the location to avoid stirring up the bottom – get as close to the shoreline as you can in your boat. Samples must be taken where the water depth is between 50cm and 150cm (1½ft – 4½ft). Use your Secchi disc to ensure you are at the correct depth.
3. Use an anchor if necessary due to waves.
4. Hang the thermometer over the shady side of your boat so it hangs in the water.
5. Record wave action on your data sheet.
6. Record the Secchi depths – up & down - on the data sheet (at the deepwater sites only).
7. Record any unusual occurrences or things that might affect the sampling results, such as the presence of wildlife or construction.
8. Take pictures of sites if needed, especially if they have changed or if any unusual observations have been made.

9. Collect all of the samples that are required at that site (listed on your binder). Specific sampling protocols are listed below.
 - Phosphorus
 - DOC
 - Bacteria
10. Put samples in a cooler as soon as possible.
11. Retrieve the thermometer and record water temperature on the data sheet.
12. Move on to your next site.

Secchi Depth – Deepwater and Wide Watercourse Sites only:

1. Remove your sunglasses if you are wearing any.
2. Lower the Secchi disk on the attached rope into the water on the shady side of the boat.
3. Lower the disk until you can no longer see it (where you can no longer distinguish between the white and black portions of the disk).
4. Record this depth on your data sheet under “Secchi Down” in metres (the depth is indicated on the rope – tabs are placed every 10cm. Estimate to the nearest tenth of a metre).
5. Lower the disk a little further.
6. Raise the disk towards the boat until it reappears.
7. Record the depth it reappears in metres on your data sheet under “Secchi Up”.
8. Retrieve the disk, making sure that the rope doesn’t get tangled.

Extra tips:

You can use clothes pegs to mark the rope – two different colours to indicate “up” and “down” and then measure the rope.

Measure the depth from the surface of the water to the Secchi disk.



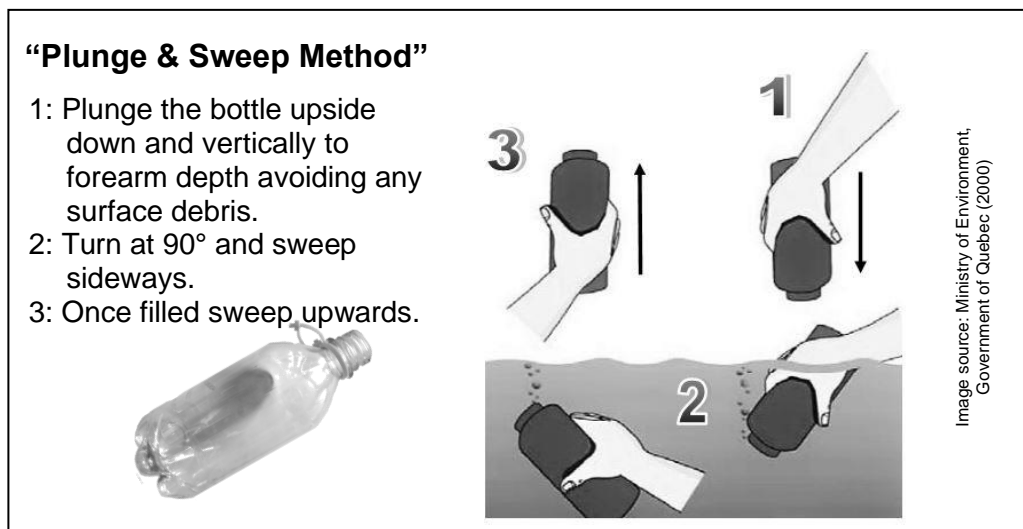
Phosphorus Sample Collection – Deepwater and wide Watercourse Sites

1. Get Phosphorus bottles ready with correct site number.
2. Rinse the sample collection bottle twice using the “plunge & sweep method” (see below).
3. Rinse the filter twice with water from the collection bottle (fill and allow water to pass through).

Do not rinse phosphorus sample bottles, as they contain a preservative

4. Clip the sample collection bottle to the Secchi disk and attach using the rubber ties in vertical position.
5. Lower the sample collection bottle down to the Secchi depth (average of “up” and “down” depths). The bottle will fill up on the way down. Try to drop the bottle as quickly as possible. Pull up the secchi and bottle once filled.
6. Pour water through the filter into the phosphorus sample bottle, being careful not to touch the inside of either the bottle or cap. ***Fill to shoulder of bottle***. Make sure the lid is screwed on snugly.
7. If performing a duplicate phosphorus sample, pour the same water used for the first sample out of the collection bottle, through the filter, and into the phosphorus collection bottle.
8. Keep the samples cool and shaded from the sun until they can be delivered to the MLA office or your Team Leader.

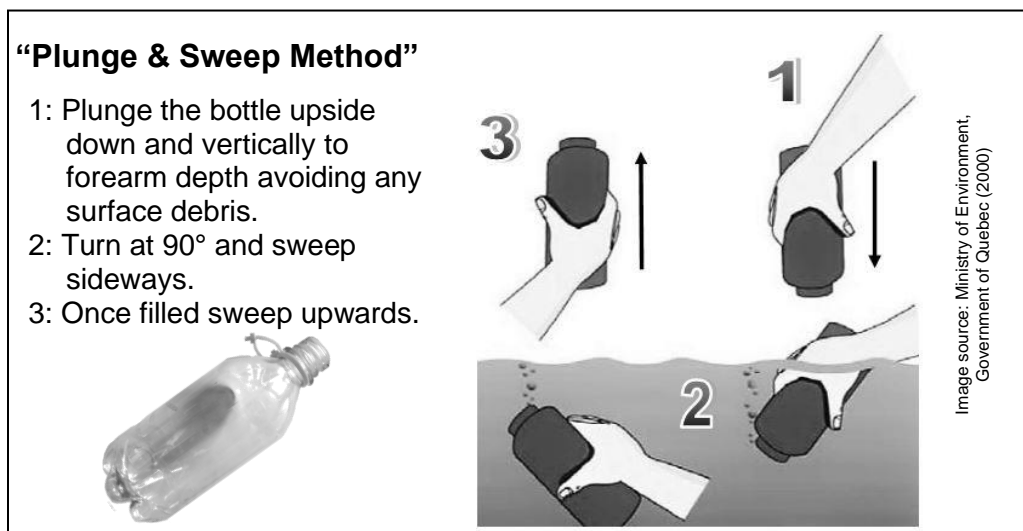
Note: The filter components are held together by friction. If they come apart, reassemble the two halves with the filter screen between the upper and lower sections.



Phosphorus Sample Collection – Nearshore and Watercourse Sites

1. Get Phosphorus bottle ready with correct site number.
2. Rinse the sample collection bottle twice using the “plunge & sweep method” (see below).
3. Rinse the filter/funnel twice with water from the collection bottle (fill and allow water to pass through).
4. Use the “plunge and sweep method” to fill the sample collection plastic bottle.
5. Pour water through the filter and into the phosphorus sample bottle, being careful not to touch the inside of either the bottle or cap. ***Fill to shoulder of bottle***. Make sure the lid is screwed on snugly.
6. Keep the samples cool and shaded from the sun until it can be delivered to the MLA office or your Team Leader.

Note: The filter components are held together by friction. If they come apart, reassemble the two halves with the filter screen between the upper and lower sections.



Bacteria Sample Collection – Nearshore and Watercourse Sites Only

1. Get bacteria jar ready with correct site number.
2. Fill Bacteria bottle using “plunge & sweep method” leaving some air at top.
3. Make sure the lid is screwed on snugly.
4. Keep the sample cool and shaded from the sun until it can be delivered to the team leader for incubation and analysis.

Samples should be analyzed as soon as possible after collection



Extra Tips

What if I have to reuse a jar from a previous sampling?

You should have enough jars in your kit so you don't need to use a jar twice. But if you do, wash your jar and lid at home with boiling water, do not use soap or detergent.

Storing used jars:

Please do not leave the lids on your jars once used (to prevent rust formation).

How do I know if I need to do a re-test?

After analyzing your sample, your Team Leader and/or the MLA office will contact you if you need to do a re-test. In that case, you will have to take two bacteria samples.

“Plunge & Sweep Method”

- 1: Plunge the bottle upside down and vertically to forearm depth avoiding any surface debris.
- 2: Turn at 90° and sweep sideways.
- 3: Once filled sweep upwards.

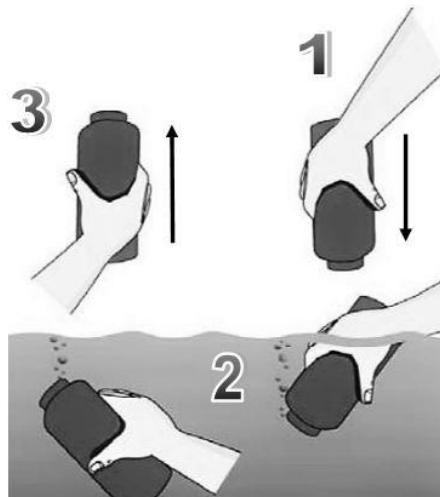


Image source: Ministry of Environment,
Government of Quebec (2000)

7. Glossary

Affiliate

Is a neighbouring community group representing stakeholders of a lake, lakes or part of a lake apart from those that would otherwise be subject to the delivery of WQI, engaged for the period of this Agreement by the MLA for the purpose of delivering WQI on the lake, lakes or part of a lake for which the group represents stakeholders.

Escherichia Coli

An emerging enterotoxigenic coliform spread by fecal contamination of animal or human origin to food and water (Madigan et al, 2000). E.Coli is typically used as an indicator of fecal contamination. The O157:H7 strain is the only strain of E.Coli that is itself harmful to humans. Unpredictable numbers of organisms indicate contamination.

Eutrophication

Is the process by which lakes gradually age and become more biologically productive. Eutrophication normally takes thousands of years to progress. However, humans have greatly accelerated this process in thousands of lakes around the globe. More details at <http://www.umanitoba.ca/institutes/fisheries/eutro.html> (University of Manitoba, 2002)

Indicator Organisms

Organism used to represent all human enteric pathogens, due to its ease of detection, and its ability to conservatively estimate the presence of pathogens. Total coliforms, including E.Coli, are most often used (Henry and Heinke, 1996).

Leader

Is a volunteer who has successfully completed leader training and has the following responsibilities on all sample dates during the sampling period:

- a) Ensuring responsibilities of volunteer team are fulfilled;
- b) Analyzing bacteria samples according to protocols and practices demonstrated in leader training and outlined in this manual;
- c) Completing data entry as required on data sheets and online; and
- d) Delivery of phosphorous samples to MLA office before 10 a.m. on Wednesday of sampling week.

Parameters

Each measurement of water quality is called a parameter. The parameters used in the WQI are total Coliform, E.Coli, total phosphorus, turbidity and temperature.

Phosphorus

Phosphorus is a component of DNA and RNA and essential element for all living cells. Phosphorus is usually the limiting nutrient in Canadian Shield aquatic ecosystems, which means that adding phosphorus to such an ecosystem results in increased plant growth. Human-based phosphorus sources greatly speed up the process of eutrophication. The most important commercial use of phosphorus-based chemicals is the production of fertilizers.

Sample Date

Means the period of time during which a single iteration of the sampling protocols and associated analysis takes place (typically beginning Monday morning and finishing Tuesday afternoon).

Sampling Area

A geographic location named in supporting documentation and encompassing a group of sites.

Sampling Period

The period of time between May 2017 and September 2017 during which four (4) sample dates for each site will be scheduled.

Secchi Depth

Secchi depth is a parameter used to determine the clarity of surface waters. The measurement is made with a “secchi” disk, a black and white disk that is lowered into the water and the depth is recorded at which it is no longer visible.

Site

The discrete and unique location as identified in supporting documentation where samples are to be collected on each sample date.

Total Coliform

All aerobic and facultative anaerobic, gram-negative, non-spore-forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35 degrees Celsius (APHA et al, 1985). Unpredictable numbers of organisms indicate contamination.

Turbidity

Turbidity is a cloudiness or haziness of water (or other fluid) caused by individual particles (suspended solids) that are generally invisible to the naked eye, thus being much like smoke in air. Turbidity is generally caused by phytoplankton. Measurement of turbidity is a key test of water quality.

Volunteer

Is an agent of the MLA or Affiliate who successfully completes volunteer training and participates without remuneration in WQI as part of a volunteer team.

Volunteer Team

Is a group of volunteers that may include a leader who are collectively responsible for the collection of samples and recording of water temperature and metadata at all sites within a designated sampling area according to WQI protocols and procedures demonstrated in volunteer training and addressed in supporting documentation thereto; at least one trained volunteer must participate on the volunteer team on each sample date during the sampling period.

Sample Area: LAK-Lake Name

| | | | |
|----------------------------------------------------------|--------------|------------------|---------------------|
| Date | July 1, 2011 | Sample Time | 2:00 pm |
| Trained Sampler | John Doe | Other Volunteers | Jen Doe & Tom Smith |
| Rainfall in last 24 hours (heavy, moderate, light, none) | heavy | Air Temp. | 16°C |

Site Specific Information

Please note that all measurements taken should be in metric

| Site Code | Water Temp. | Waves | Secchi Down | Secchi Up | Blue | Blue & Flor. |
|-----------|-------------|----------------------------------------------------------------------------|-------------|-----------|------|--------------|
| LAK-0 | 19°C | <input type="checkbox"/> Calm <input checked="" type="checkbox"/> Rough | 1.7 m | 2 m | N/A | N/A |
| LAK-1 | 20°C | <input checked="" type="checkbox"/> Calm <input type="checkbox"/> Rough | N/A | N/A | 12 | 8 |
| LAK-2 | 22°C | <input checked="" type="checkbox"/> Calm <input type="checkbox"/> Rough | N/A | N/A | 3 | 0 |
| LAK-3 | 21°C | <input checked="" type="checkbox"/> Calm <input type="checkbox"/> Rough | N/A | N/A | 5 | 2 |
| LAK-4 | 19°C | <input checked="" type="checkbox"/> Calm <input type="checkbox"/> Rough | N/A | N/A | 24 | 16 |
| | | <input type="checkbox"/> Calm <input type="checkbox"/> Rough | | | | |
| | | <input type="checkbox"/> Calm <input type="checkbox"/> Rough | | | | |
| | | <input type="checkbox"/> Calm <input type="checkbox"/> Rough | | | | |
| | | <input type="checkbox"/> Calm <input type="checkbox"/> Rough | | | | |

For Team Leader Use:

| |
|-----------------------------------------------|
| Preparation Date/Time: <i>July 2 @ 8am</i> |
| Analysis Date/Time: <i>July 3 @ 11am</i> |
| Analysis done by: <i>John Doe</i> |
| |
| |
| |

Comments:

Large flock of Canada geese sighted at LAK-4
